

## Laser-driven hydrodynamics experiments at Nova\*

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Hydrodynamic instabilities play a critical role in inertial confinement fusion capsule performance, both in direct and in indirect drive. In our indirect-drive work at the Nova laser, we have examined the effects on Rayleigh-Taylor (RT) growth of 2D versus 3D single-mode perturbation shape,<sup>1</sup> and perturbation location at the ablation front versus at an embedded interface.<sup>2</sup> In our current experiments, we are investigating multimode coupling effects at an imbedded interface,<sup>3</sup> the differences in single-mode RT growth in planar versus convergent geometry using face-on radiography of hemispherical implosions,<sup>4</sup> and the RT dispersion curve of an unstable embedded interface in the solid state versus liquid state.<sup>4</sup> In the solid-state experiment, our initial efforts are focused on characterizing the state of samples of Si and Cu as they get compressed, while remaining in the solid state.

In our direct-drive work, we have measured the RT dispersion curve in the-linear regime over perturbation wavelengths of 20-70  $\mu\text{m}$ , using a 1D SSD smoothed,  $\lambda_{\text{laser}}=0.528 \mu\text{m}$  (green) single Nova beam at  $I=1 \times 10^{14} \text{ W/cm}^2$ . We are also examining the critical issue of laser imprinting, using both thin foils of Si with an XUV backlighter<sup>5</sup> and drive laser at  $\lambda_{\text{laser}}=0.351 \mu\text{m}$  (blue),  $I=3 \times 10^{12} \text{ W/cm}^2$ , and thick foils of  $\text{CH}_2$  with an U backlighter<sup>6</sup> and drive laser at  $\lambda_{\text{laser}}=0.528 \mu\text{m}$ ,  $I=1 \times 10^{14} \text{ W/cm}^2$ . Our latest experiments compare imprint from blue versus green laser light under similar gross hydrodynamics. The drive laser was smoothed only with a static random phase plate, the intensity was held fixed at  $I=1 \times 10^{13} \text{ W/cm}^2$ , and the lasers were subapertured (f/11 for green, f/15.6 for blue) to have the same speckle power spectrum. Data and simulations both indicate that the imprint from the blue laser is considerably larger than that from the green laser,<sup>7</sup> consistent with the simple picture of smoothing via a thermal standoff layer.

Under the new university use of Nova program, we have initiated an experiment on the Nova laser in collaboration with the University of Arizona to investigate specific issues regarding hydrodynamic instabilities in supernovae.<sup>8</sup> The goal is to investigate the evolution of the Richtmyer-Meshkov and RT instabilities in the deep nonlinear regime in a scaled setting similar to that occurring at the He-H interface of a Type II supernova. \*Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.

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